

09/856643

JG19 Rec'd PCT/PTO 22 MAY 2001

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
DO/EO/US

International Application No. PCT/NO98/00347
International Filing Date: November 25, 1998

Priority Application: (No Priority Claim in PCT Application)
Priority Date: (Not Applicable)

Applicant(s) for EO/US: Morten MOEN et al.

Title of Invention: METHOD FOR ESTABLISHING
ALTERNATIVE ROUTES IN A
TELECOMMUNICATION NETWORK

Box DO/EO/US
Assistant Commissioner for Patents
Washington, D.C. 20231

Madam or Sir:

CERTIFICATE OF MAILING BY EXPRESS MAIL	
"EXPRESS MAIL" Mailing Label No.:	EL628365532US
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<p>I hereby certify that this paper, including the documents referred to therein, or fee is being deposited with the U.S. Postal Service "Express Mail Post Office to Addressee" service under 37 C.F.R. § 1.10 on the date indicated above and is addressed to the:</p> <p>Box DO/EO/US Assistant Commissioner for Patents Washington, D.C. 20231</p>	
Type or Print Name	Carla Elkins
Signature	<i>Carla Elkins</i>

REQUEST FOR PCT NATIONAL ENTRY IN THE US
UNDER 35 U.S.C. § 371 AND 37 C.F.R. § 1.495

This is an express request to begin national examination procedures of International Application Number NONE under 35 U.S.C. § 371 and 37 C.F.R. § 1.495 in the United States Patent and Trademark Office.

- ☒ Enclosed are 9 pages of the specification, 4 pages of claims, and 1 page containing the abstract of International Application No. PCT/NO98/00347 as published.
- ☒ Three sheets of formal drawings containing a total of four figures are enclosed.

DOCKET NO.
28170-00028

- [illegible]

Inventor	Name	Address	Citizenship
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4. ☐ The International Bureau confirmed that it had received a certified copy of priority application as filed on _____ during the international stage of this PCT application by mailing Form PCT/IB/304 to the Applicant(s) indicating such.
5. ☒ A proper Demand for International Preliminary Examination of the international application was made by the 19th month from the earliest claimed priority date. The United States was elected in the Demand. The International Bureau reported to the Applicant(s) that it had notified the EO/US in accordance with PCT Article 31(7) of its election for Chapter II proceedings.
6. ☒ Combined Declaration and Power of Attorney of the inventor(s): _____ Signed
_____X_____ Unsigned.
7. ☒ An Information Disclosure Statement Under 37 C.F.R. § 1.97(b) is enclosed, along with Form PTO-1449 and a copy of each reference identified on Form PTO-1449.
8. ☐ A Preliminary Amendment is enclosed.

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9. ☒ The International Application was searched and examined in the English language.
10. ☐ A translation of the International Application into English (35 U.S.C. § 371(c)(2)) is enclosed.
11. ☐ A translation of the amendment(s) to the International Application under PCT Article 19 into English (35 U.S.C. § 371(c)(3)) is(are) enclosed.
12. ☐ A translation of the annex(es) to the International Preliminary Examination Report made under PCT Article 36 into English (35 U.S.C. § 371(c)(5)) is(are) enclosed.
13. ☐ Translation(s) of the following additional PCT documents is/are enclosed:
14. ☐ A Petition to Make Special For New Application Under MPEP § 708.02, VIII is enclosed, along with Form PTO-1449, and a copy of each reference identified on Form PTO-1449.
15. ☐ This entity and/or independent inventor qualifies for small entity status under 37 C.F.R. § 1.9(f) and/or § 1.27(b). The following supportive documentation reflecting such is attached:
16. ☒ In determining the Basic Fee, the following aspects of the progression of the PCT application were considered:

Searching Authority

Swedish Patent Office

Examining Authority

Swedish Patent Office.

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17. ☒ The filing fee is calculated by adding the appropriate Basic Fee to the fees for the number and types of claims presented for national entry under 37 C.F.R. § 1.492, specifically:

FOR	NUMBER	NUMBER EXTRA	RATE	CALCULATION
TOTAL CLAIMS	53 -20=	33	x \$ 18.00 =	\$ 594
INDEPENDENT CLAIMS	1 -3=	-2	x \$ 80.00 =	\$ 0
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			x \$ 270 =	\$ 270
			BASIC FEE	\$ 1000
			TOTAL OF ABOVE CALCULATIONS =	\$ 1864
REDUCTION BY ½ FOR FILING BY SMALL ENTITY OR INDEPENDENT INVENTOR (Note 37 C.F.R. §§ 1.9, 1.27, 1.28)				0
			Total =	\$ 1864

18. ☒ A check in the amount of \$1,864.00 for the application fee is enclosed.
19. ☒ The Commissioner is hereby authorized to charge fees under 37 C.F.R. § 1.492 which may be required to complete national entry, or credit any overpayment to Deposit Account No. 10-0447 of JENKENS & GILCHRIST, P.C. The reference number 28170-00028 should be included in any deposit account transactions. A duplicate copy of this sheet is enclosed.
20. ☒ Address all future communications to:

Stanley R. Moore, Esq.
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23932

PATENT TRADEMARK OFFICE

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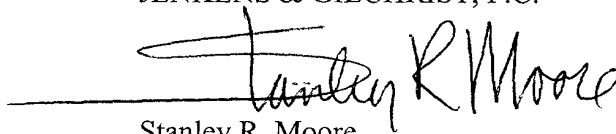
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21. ☒ Also enclosed:

1. Copy of International Preliminary Examination Report (IPER)
as Prepared by IPEA/SE (5 pages);
2. Amended Sheets 10 - 12 as Attached to IPER (3 pages);
3. Certificate of Express Mailing No. EL628365532US; and
4. Confirmation Postcard.

Respectfully submitted,
JENKENS & GILCHRIST, P.C.



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METHOD FOR ESTABLISHING ALTERNATIVE ROUTES IN A
TELECOMMUNICATION NETWORK

5 Field of the invention

The present invention relates to a method for establishing alternative routes in a telecommunication network, especially in case of transmission failure, and more specifically in a telecommunication network comprising transmission links for duplex operation.

More specifically the present invention relates to a method for constructing an autonomous self healing ring in a 2 MBit/s leased line telecommunication network in order to create redundancy in the network in case of transmission failure.

20 Technical background

THE PROBLEM AREA

The problem area concerns building a transmission network between digital cross-connects in such a way that alternative routes are introduced in case of transmission failures. This is desirable in order to keep the network up and running when failures occur. As described below, earlier solutions have involved expensive dual lines or slow remote management involvement. In certain applications, such as cellular networks, it is important that the solution is at low cost and that the network disturbance does not last so long as to disrupt on-going traffic.

35

KNOWN SOLUTIONS

Known solutions for providing network protection in a 2 MBit/s telecommunications network include

- 5
- 1+1 protection
 - N+1 protection
 - NMS re-routing
 - Ring topologies

10

1+1 protection uses duplicated lines between nodes. Traffic is sent out identically on both lines, and the receiving node chooses the 'best' line. The entire protection operation including detection of problems and switching of input source is performed at the receiving end. Switching is autonomously and fast and does not include network management system involvement.

15

N+1 protection adds one extra line to a group of N lines. The stand-by line will take over for any of the other lines in case of failure. There is no traffic on the stand-by line before the failure, and switching will have to take place at both ends.

20

In the case of NMS re-routing, the network is generally built with extra capacity in the lines. In case of failure, the traffic from the failed line is re-routed on other lines. This operation is conducted by a network management system (NMS).

25

30

There are ring protection solutions that use the fact that any node in a ring may be reached in two ways. They mainly fall into two groups:

- 35
- Nodes in the ring keep an updated database of all nodes in the ring with information on which time slots belong to these nodes. When a fault occurs, the ring is split and time slots are selectively transmitted on

the right or left branch according to this information.

- When a fault occurs, information is sent to a central management system that decides on the re-configuration of the nodes in the ring.

PROBLEMS WITH KNOWN SOLUTIONS

- 10 The problem with the 1+1 protection has been that this is a very costly alternative as every line segment must be duplicated.

15 The N+1 solution is a limited solution since it can only protect a number of line segments between the same nodes.

The NMS re-routing solution is generally too slow for application requiring connections to stay up. For instance, the GSM traffic in cellular networks will go down if the protection is based on NMS re-routing.

The problem with existing ring solutions is that they generally are more complex and thus more expensive and subject to errors than the suggested ring solution.

25 Also, in the case of needing to use a central management system for restoration, switching is not fast enough to be used in for instance cellular networks.

30 Objects of the invention

An object of the present invention is to provide a method for establishing alternative routes in a telecommunication network which generally is not hampered with the problems enfacd with known solutions.

Another object of the present invention is to provide a method which is less complex and less expensive as well

as less subject to errors than previously suggested ring solutions.

Still another object of the present invention is to provide a method wherein the use of a central management system for restoration is reduced to a minimum.

Yet another object of the present invention is to provide a method which is autonomously self healing, and wherein the healing is accomplished in a minimum of time.

Another object of the present invention is to provide a method wherein the self healing means are included in the nodes of the network.

Brief summary of the invention

These objects are achieved in a method as stated in the preamble, which according to the present invention is characterized by

- arranging said network in one or more initial rings including duplex operation between the nodes included in each ring, and by
- arranging said nodes such as to let all time slots be transmitted in one and the same direction (OK direction) of the ring in question whilst maintaining the opposite direction (ERROR direction) as a standby or redundancy path.

Further objects and advantages of the present invention will appear from the following description taken in conjunction with the enclosed drawings, as well as from the enclosed patent claims.

Brief disclosure of the drawings

Fig. 1 is a simplified sketch illustrating an initial
protected ring wherein the present invention has been im-
5 plemented.

Fig. 2 is a simplified sketch illustrating details in one
of the nodes which are tied into the ring by dropping and
inserting time slots.

10 Fig. 3 is a simplified sketch, similar to Fig. 1, illus-
trating the ring after switching to redundancy mode.

Fig. 4 is a simplified sketch illustrating a ring con-
15 figuration before, during and after a transmission fault
occurs.

Detailed description of embodiments

20 It is to be understood that the present invention has
been developed in connection with 2 Mb/s transmission
links which are always duplex, but it is to be understood
that the general principle of the present invention can
25 be applied in any telecommunication network comprising
transmission links for duplex operation.

In Fig. 1 there is illustrated an example of a ring in-
cluding 4 nodes, designated A, B, C, D, respectively.
30 Such a ring may be included as one of more rings in a
network and between each node in the ring in question
there is established a duplex operation.

In the following it is assumed that the example of the
35 ring illustrated in Fig. 1 is established for a 2 Mb/s
transmission link.

2 MBit/s transmission links are always duplex. There is symmetrical transmission in both directions. This symmetrical nature of the 2 Mbit/s network makes it possible to set up a ring where all time slots are transmitted in one direction while the other direction is not used. The empty direction may then be used as a stand-by path. The initial ring is shown in Fig. 1. The normal direction is called the OK direction. The spare direction is called the ERROR direction.

By using bits in time slot 0, it is possible to monitor each 2 Mbit/s section in the ring for both directions. A transmission fault on a section can thus be detected at both ends and re-routing of the time slots to the spare capacity may be done in both affected nodes.

The fault criteria may be:

- LIS - Loss of Incoming Signal
- LFA - Loss of Frame Alignment
- RAI - Remote Alarm Indication

For a cross-connect node, the timing information is usually taken from one of the incoming line signals. In the protected ring, timing is propagated along with the normal traffic direction. When the traffic switches, the timing will also have to switch.

Other nodes are tied into the ring by dropping and inserting time slots as shown in Fig. 2. Most of the time slots entering the node in the OK direction is fed right through the node. Time slots destined for the connected equipment are dropped off to the port where this equipment is connected. Time slots from the connected equipment is inserted into the OK direction thus keeping the one-way traffic in the ring.

If the ring should be treated as a sub-network connecting to a central node such as the BSC in cellular networks, all time slots would be dropped towards this node.

- 5 When a fault occurs on a section in the ring the two nodes in both ends of that section will be triggered by the switching criteria. The two nodes will then re-configure so that traffic that normally would be sent out on the faulted section will be routed back onto the ERROR direction. Traffic that normally would be taken from the faulted section will instead be taken from the ERROR direction. This is shown in Fig. 3 where the fault occurred between nodes C and D.
- 10
- 15 If, in Fig. 3, node D received timing information from node C, its timing source would have to change. This is trivial for node D because this node is next to the faulty section and is able to detect the switching criteria. However, had there been more nodes between nodes D and A, for example nodes DX, DY and DZ, these would also have to change timing sources. These nodes do not have access to the same fault information as have nodes D and C.
- 20
- 25 To make these nodes aware of the need to switch timing source, one of the spare bits in time slot 0 is used as a timing source bit. On ports used as timing source, this bit is sent in the high state. On all other ports the bit is sent in the low state. It is not legal to use a port with the incoming timing source bit in the high state as a timing source. As node D starts using the other (non faulty) port as timing source, the timing source bit will force the node at the other end to change timing source if timing previously was taken from node D.
- 30
- 35 This will ripple through all possible nodes between nodes D and A until the complete rightmost branch takes timing from node A. Clock stability requirements secure that

the timing change information is transported before bit-slip will occur.

In other words when the node D immediately following the
5 faulty section starts using the other non-faulty/redundancy channel port as timing source, then the timing source bit will force the next node DX in the redundancy ERROR direction to change its timing source if timing was previously taken from said next to fault node
10 D, which forcing will take place also in any still further nodes DY, DZ arranged between said next to fault node D and said node A being connected to a central node CN.

15 In Fig. 4 there is illustrated another ring configuration between four other nodes R, S, T and U, wherein a transmission fault has occurred between the nodes S and T.

Fig. 4 further illustrates how ports used as timing
20 source will send one of the spare bits in time slot 0 in the high state, whereas on all other ports this bit is sent in the low state. Further, Fig. 4 illustrates that when node S, due to a transmission fault, will have to use the redundancy or error path, it will establish its
25 output port as a timing source, i.e. especially for the closest node R, which further communicates the redundancy path to node U and node T, in which latter node T the incoming of time slots on the redundancy port thereof will set the associated timing source bit to high state. This
30 high state will be transferred from node T to node U, and further to node R, but then via the OK path, until the correct timing configuration is established.

35 Advantages

There are several advantages to this invention. They may be summarised as follows:

Usually redundancy creates largely increased costs due to duplication of transmission capacity. The suggested redundant ring only needs one extra section and the inherent spare capacity in duplex lines to protect a number of other sections and is thus less costly.

The switching of time slots and timing sources are completely autonomous and does not require any interaction with a remote management system. Switching is thus rapid and restoration of connections is done with minimum interruption of traffic.

Because only the two nodes in either end of the faulty section is actively involved in the switching, there is no need for additional complexity in order to synchronise other nodes in the ring with configuration information. The suggested solution is thus less complex, less expensive and more reliable.

04-01-2001

P a t e n t c l a i m s
(amended 04.01.2000)

1. Method for establishing alternative routes in a
5 telecommunication network, especially in case of trans-
mission failure, and more specifically in a telecommuni-
cation network comprising 2 Mbit/s transmission links and
nodes with G.704 framing for duplex operation, wherein said
network is arranged in one or more initial rings including
10 duplex operation between the nodes included in each ring,
c h a r a c t e r i z e d b y

- Arranging said nodes, due to the symmetrical nature of
the 2 Mbit/s network, such as to let all time slots be
15 transmitted in one and the same direction (OK direction) of
the ring in question whilst maintaining the opposite direc-
tion (ERROR direction) as a standby or redundancy path un-
til alerted by a specific time slot reflecting the occur-
rence of a fault,

20 - Providing a time slot, preferably time slot 0, with
alerting means that are adapted to monitor each section in
the ring in question for both directions, said alerting
means being defined by the bit configuration of said time
25 slot.

2. Method as claimed in claim 1,
c h a r a c t e r i z e d i n that each node is pro-
vided with detection means adapted for detecting a section
30 transmission fault both at the incoming or at the outgoing
ports thereof, i.e. allowing detection of a transmission
fault on a section at both ends of said section.

3. Method as claimed in claim 1 or 2,
35 c h a r a c t e r i z e d b y letting inter alia the fol-
lowing fault criteria determine the re-routing of the time
slots:

 LIS - Loss of Incoming Signal

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LFA - Loss of Frame Alignment

RAI - Remote Alarm Indication

4. Method as claimed in any of the preceding claims,
5 c h a r a c t e r i z e d i n that during normal and
initial ring operation the timing information will pre-
ferably be taken from one of the incoming signals, i.e.
signals being propagated along the normal (OK) direction.
- 10 5. Method as claimed in any of the preceding claims,
c h a r a c t e r i z e d i n that when a fault occurs
on a section in the ring the two nodes at the end of that
faulty section will be triggered by one or more appropriate
switching criteria, for thereby reconfiguring the two nodes
15 in question for routing the traffic which should have been
sent via the faulty section to its destination node or
nodes via the duplex channel in the opposite (ERROR) direc-
tion.
- 20 6. Method as claimed in any of the preceding claims,
c h a r a c t e r i z e d i n that when a fault occurs
in a section between two nodes then the node immediately
following the faulty section in the previous normal (OK)
direction will have its timing source changed upon detec-
25 tion of the appropriate fault occurrence switching cri-
teria, and that any further node or nodes being arranged
between said immediately following node and a node (A) be-
ing connected to a central node (CN) will also have its or
their timing sources changed.
- 30 7. Method as claimed in claim 6,
c h a r a c t e r i z e d i n that one of the spare
bits in time slot 0 is used as a timing source bit and that
on ports being used as a timing source this bit will be
35 given a first state, preferably the high state, whereas all
other ports will have the same spare bit sent in the oppo-
site state, i.e. preferably the low state.

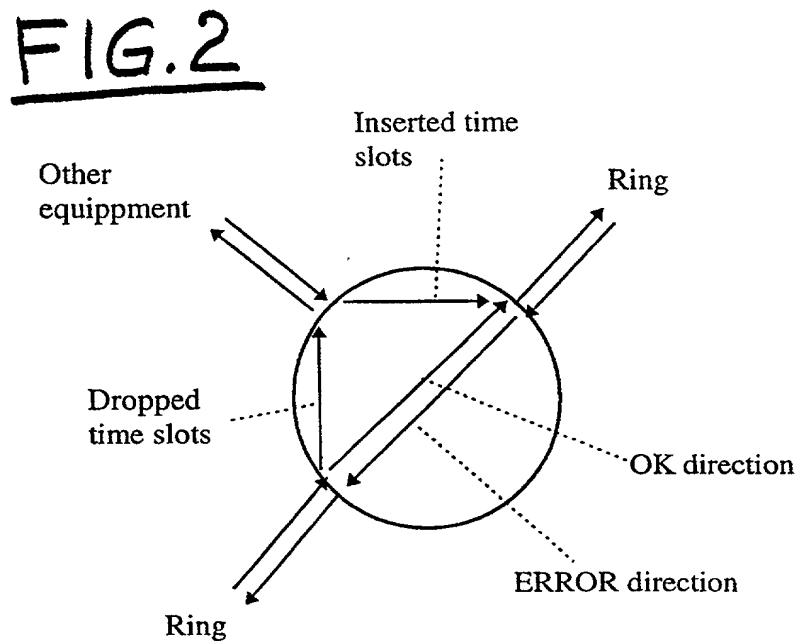
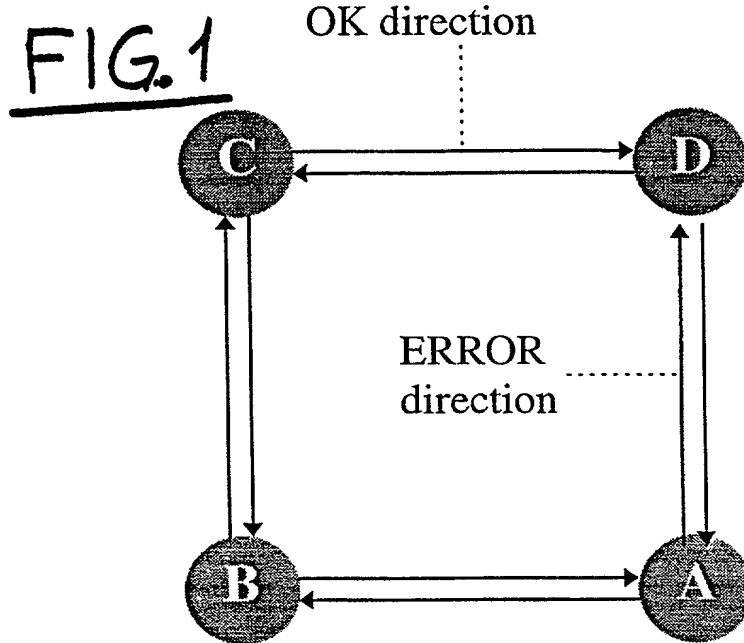
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8. Method as claimed in claim 7,
c h a r a c t e r i z e d i n that when the node (D)
immediately following the faulty section starts using the
other non-faulty/redundancy channel port as timing source,
5 then the timing source bit will force the next node (DX) in
the redundancy (ERROR) direction to change its timing
source if timing was previously taken from said next to
fault node (D), which forcing will take place also in any
still further nodes (DY, DZ) arranged between said next to
10 fault node (D) and said node (A) being connected to a cen-
tral node (CN).

9. Method as claimed in any of the preceding claims,
c h a r a c t e r i z e d i n that the transport of the
15 timing change information sent or rippled through nodes in-
volved in a redundancy (ERROR) path, i.e. receiving signals
thereon but transmitting signals on the remaining normal
(OK) path, is adapted in relation to clock stability re-
quirement so as to avoid the occurrence of bit slip.

20 10. Method as claimed in any of the preceding claims,
c h a r a c t e r i z e d i n that the method is ap-
plied in an autonomous manner, without any interaction with
a remote management system (RMS).

25 11. Method as claimed in any of the preceding claims,
c h a r a c t e r i z e d i n that the method is ap-
plied as an autonomous self healing ring, especially in a 2
Mb/s leased line telecommunication network so as to create
30 redundancy pathways therein in case of transmission fail-
ure.



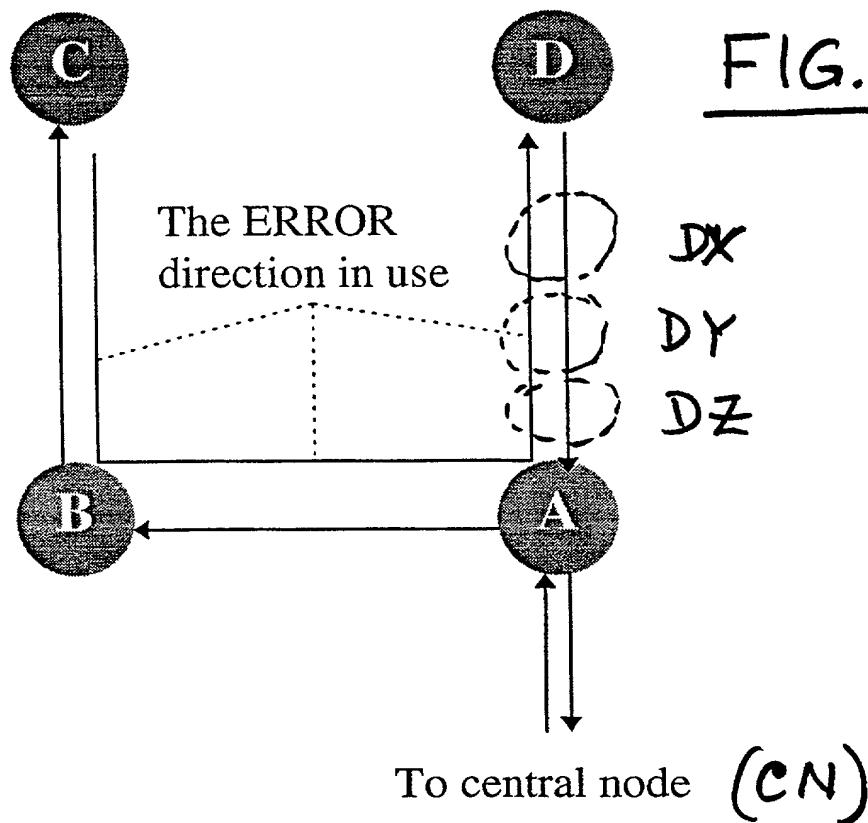
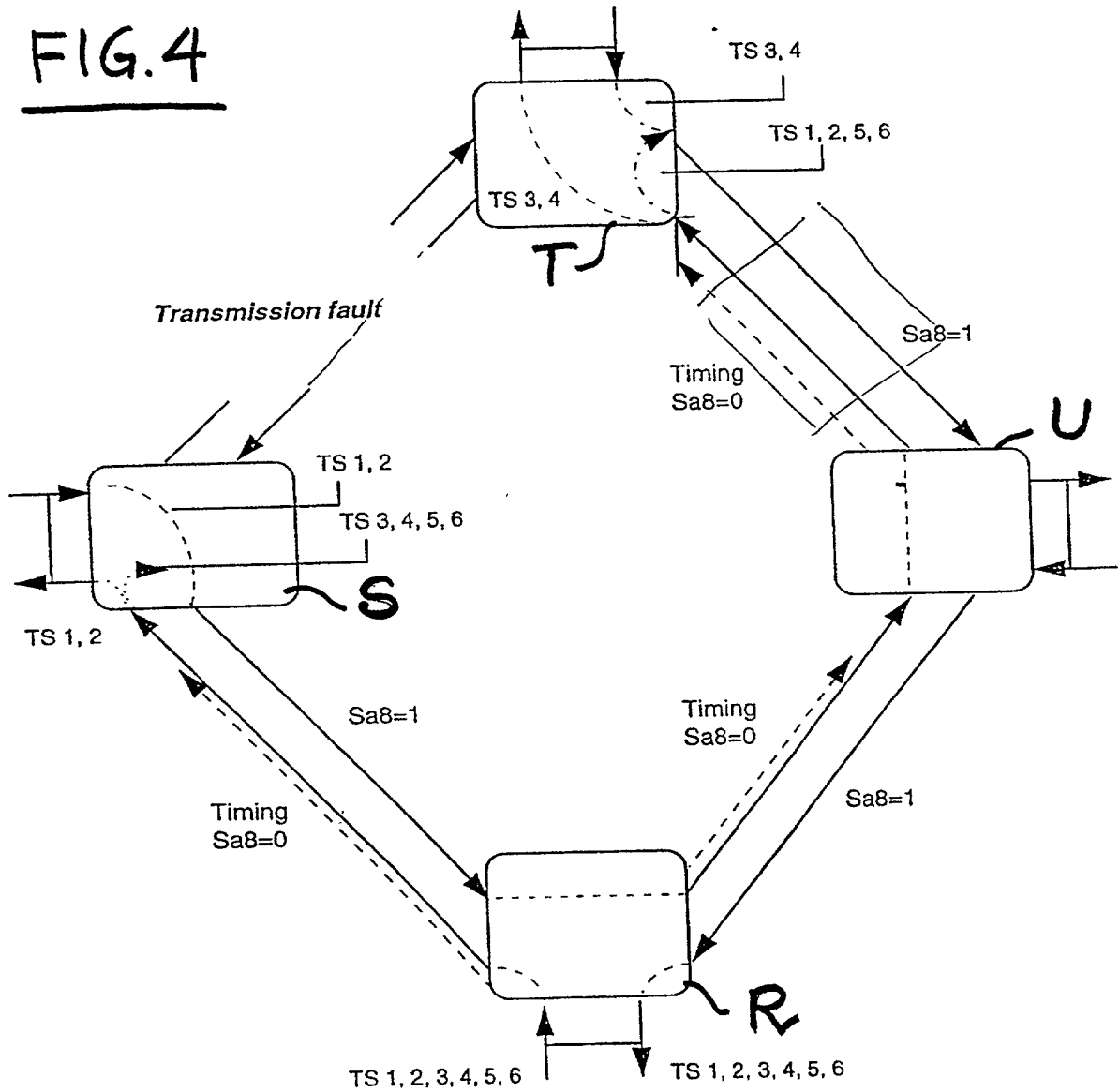


FIG.4



**RULES 63 AND 67 (37 C.F.R. 1.63 and 1.67)
DECLARATION AND POWER OF ATTORNEY****FOR UTILITY/DESIGN/CIP/PCT NATIONAL APPLICATIONS**

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name;
and

I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: **METHOD FOR ESTABLISHING ALTERNATIVE ROUTES IN A TELECOMMUNICATION NETWORK**, the specification of which: (mark only one)

- X (a) is attached hereto.
— (b) was filed on _____ as Application Serial No. _____
and was amended on _____ (if applicable)
— (c) was filed as PCT International Application No. PCT/_____ on _____
and was amended on _____ (if applicable).
— (d) was filed on _____ as Application Serial No. _____ and was issued a Notice
of Allowance on _____.
— (e) was filed on _____ and bearing attorney docket number _____
_____.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims as amended by any amendment referred to above or as allowed as indicated above.

I acknowledge the duty to disclose all information known to me to be material to the patentability of this application as defined in 37 CFR § 1.56. If this is a continuation-in-part (CIP) application, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose to the Office all information known to me to be material to patentability of the application as defined in 37 CFR § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

I hereby claim foreign priority benefits under 35 U.S.C. § 119/365 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate filed by me or my assignee disclosing the subject matter claimed in this application and having a filing date (1) before that of the

PATENT

DOCKET NO.: 28170-00028
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application on which my priority is claimed or, (2) if no priority is claimed, before the filing date of this application:

PRIOR FOREIGN PATENTS

Number	Country	Month/Day/Year Filed	Date first laid-	Date	Priority Claimed	
			open or Published	patented or Granted	Yes	No
NONE						

I hereby claim the benefit under 35 U.S.C. § 120/365 of any United States application(s) listed below and PCT international applications listed above or below:

PRIOR U.S. OR PCT APPLICATIONS

Application No. (series code/serial no.)	Month/Day/Year Filed	Status(pending, abandoned, patented)
PCT/NO98/00347	November 25, 1998	Pending

I hereby appoint:

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 ANDRE M. SZUWALSKI, Reg. No. 35,701
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 TAMSEN VALOIR, Reg. No. 41,417
 BRIAN D. WALKER, Reg. No. 37,751
 GERALD T. WELCH, Reg. No. 30,332
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all of the firm of **JENKENS & GILCHRIST, a Professional Corporation**, 1445 Ross Avenue, Suite 3200, Dallas, Texas 75202-2799, as my attorneys and/or agents, with full power of substitution and revocation, to prosecute this application, provisionals thereof, continuations, continuations-in-part, divisionals, appeals, reissues, substitutions, and extensions thereof and to transact all business in the United States Patent and Trademark Office connected therewith, to appoint any individuals under an associate power of attorney and to file and prosecute any international patent application filed thereon before any international authorities, and I hereby authorize them to act and rely on instructions from and communicate directly with the person/assignee/attorney/firm/organization who/which first sent this case to them and by

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whom/which I hereby declare that I have consented after full disclosure to be represented unless/until I instruct them in writing to the contrary.

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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